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Sodium Chlorate

RMI TITANIUM

RMI Company

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October 13, 1981

Mr. Douglas C. Hasbrouck, P.E.
District Chief
Ohio Environmental Protection Agency
2110 E. Aurora Road
Twinsburg, Ohio 44087

Dear Mr. Hasbrouck:

Reference: Industrial Status Report, Dated: August 13, 1981

A report entitled "INDUSTRIAL COMPLIANCE SAMPLING INSPECTION REPORT" prepared by Robert E. Buda and dated August 13, 1981 was received by E. R. Toth, Jr., RMI Company, on August 19, 1981. The following information, which is found in said report under the heading "FACILITY DESCRIPTION", is proprietary in nature and confidential; therefore remove it from the public record and supply a list of all individuals, agencies, organizations, etc. which possess a copy of the report. If possible, have all distribution copies marked CONFIDENTIAL.

> "The RMI Company has installed three different wastewater treatment systems. These consist of a lime addition facility and a series of five settling ponds, a chlorine gas recovery facility and a facility for catalytic decomposition of hypochlorite.
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> "In the first system, contaminated chlorine gas is reacted with lime to prevent its release to the atmosphere. The reaction produces a solution of calcium hypochlorite and calcium chloride which is eventually discharged into holding ponds. Contaminated chlorine gas results from separate operations. Gas from the first operation is termed "off gas" and results from chlorine which escapes from the cells when they are being worked on or are not operating properly. This gas stream has a high volume of air, dust and miscellaneous impurities. Chlorine recovery in a pure enough state is not economical.
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> "The second source of contaminated chlorine gas is called "sniff" and "tail" gas. Sniff gas is residual chlorine in empty tank cars and must be removed before refilling. Tail gas is chlorine which remains from the liquefaction process.

"The chlorine recovery process involves the alternate absorption-desorption of chlorine on a bed of silica gel in a cyclic process. The system consists of a series of tanks, heat exchangers, a two stage vacuum pump, connecting piping, controls and miscellaneous apparatus. It is designed to handle all of the tail and sniff gas normally expected when the plant facilities are operating at their designed capacity. In this way 90-96 percent of the elemental chlorine contained in the tail and sniff gas will be recovered and recycled to the plant chlorine liquefaction system. The residual air stream leaving the recovery facilities contains a small amount of chlorine and is routed to the existing lime neutralization facilities where it is treated to prevent air pollution.

"The following description serves to describe the basic function of the above system: Tail and sniff gas enter a guard tank which contains a shallow bed of silica gel. The primary purpose of this tank is to trap impurities which might enter the gas stream that could be detrimental to the absorption-desorption process in the tanks that follow. The cleaned gas stream enters an absorber after passing through a gas chiller. As the gas stream passes downward through the gel in the tower, the chlorine is preferentially absorbed. The silica gel is an amorphous form of pure silica which, under the proper physical conditions, has an affinity for a number of gases including chlorine. An inherent property of the gel is that for any given amount of a particular gas retained by the gel, the amount of gas retained is directly proportional to the partial pressure of the gas in question, and is inversely proportional to the temperature of the system. When a gas molecule is absorbed, its latent heat of condensation plus the additional heat released by the action of the attractive molecular forces causes the bed to warm up until a point is reached at which no further absorption occurs. The greater the partial pressure of chlorine in contact with the gel, the more chlorine the gel can hold at any given temperature. The undesired diluent, such as air, is preferentially displaced by the chlorine and passes out of the vessel of the disposal system while the chlorine remains behind bound in the gel.

"Conversely, as the gas space is evacuated, the partial pressure of the chlorine in the gas space is reduced and the gel begins to give up the absorbed chlorine in an attempt to reestablish equilibrium. This reaction continues until a condition of equilibrium is reached. At this time the incoming gas is rerouted to a second absorber and the original absorber is placed on the chlorine recovery cycle. In this portion of the recovery cycle, heat is absorbed from the surroundings in order to vaporize the chlorine and the bed cools,

theoretically back to the temperature existing at the start of the absorption process. The pressure in the original tank is reduced by the use of a two-stage vacuum pump. This cycle is controlled on a timed basis.

"The above mentioned reactions take place in towers that are separated into two sections so that the gas can be put through a cooler in order to improve the efficiency of the system as the gas passes from one section of the tower to the other. The stripped gas stream leaving the absorber flows to the neutralizing system. The chlorine gas released is routed to the existing plant liquefaction system where it is recovered as a marketable product. The operation of this system continues in this method, shifting from tank to tank on a preselected schedule. A terminal filter is present to catch any gel particles which may be carried out with the gas stream.

"The third pollution control system consists of a facility for the catalytic decomposition of hypochlorite. The hypochlorite is generated by reacting waste chlorine gas with lime in the neutralization facility. The waste chlorine gas originates as the stripped gas stream described above and as "off gas" from the Downs cells during maintenance operations or malfunctions.

"The hypochlorite wastes are collected in a settling pond and pumped continuously to a heated, agitated reactor containing cobalt hydroxide as a catalyst. Oxygen is released during the reaction and the hypochlorite waste is reduced to a chloride salt as illustrated:

$$Ca(OCl)_2 \xrightarrow{\text{Catalyst}} CaCl_2 + O_2$$

"Effluent from the first reactor flows by gravity to a second reactor for additional reaction time. The second reactor discharges to a sealing tank where a flocculating agent is added to aid in precipitating any catalyst particles that are carrier over. The catalyst particles are recycled to the first reactor. The clarified wastewater flows to a surge tank and subsequently to the third settling pond in the five pond holding and settling system."

Very truly yours,

Joe T. Holman

Joe T. Holman
Staff Environmental Engineer

cc: O. Bertea
L. S. Hanek
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B. T. Wilkens